We claim:

1. A semiconductor source of emission electrons comprising:

a) a target comprising a wide bandgap semiconductor, said target having a target thickness between an illumination surface and an emission surface;

b) a means for producing and directing a beam of seed electrons at said illumination surface;

c) a means for controlling an energy of said seed electrons such that said seed electrons generate electron-hole pairs in said target and a fraction of said electron-hole pairs supply said emission electrons; and

wherein said target thickness and the energy of said seed electrons are optimized such that said emission electrons are substantially thermalized at said emission surface.

2. The semiconductor source of claim 1, wherein said wide bandgap semiconductor has a negative electron affinity at said emission surface.

3. The semiconductor source of claim 2, wherein said side bandgap semiconductor comprises a material selected from the group consisting of diamond, AlN, BN, $Ga_{1-y}Al_yN$ and $(AlN)_x(SiC)_{1-x}$, wherein $0 \leq y \leq 1$ and $0.2 \leq x \leq 1$.

4. The semiconductor source of claim 3, wherein said wide bandgap semiconductor is diamond and said emission surface is hydrogen-terminated for generating said negative electron affinity.

5. The semiconductor source of claim 2, wherein said wide bandgap semiconductor comprises a means for generating said negative electron affinity at said emission surface.

6. The semiconductor source of claim 5, wherein said means for generating is a material coating.

7. The semiconductor source of claim 6, wherein said wide bandgap semiconductor is diamond and said means for generating is a material coating comprising Cs and O.

8. The semiconductor source of claim 1, further comprising a means for drawing said emission electrons from within said target to said emission surface.

9. The semiconductor source of claim 8, wherein said means for drawing comprises a built-in electric field induced by a bandgap ramp.

10. The semiconductor source of claim 8, wherein said means for drawing comprises an external applied electric field penetrating said target.

11. The semiconductor source of claim 1, further comprising a means for producing and directing a beam of said emission electrons.

12. The semiconductor source of claim 11, wherein said means for producing and directing comprises an external applied electric field.

13. The semiconductor source of claim 11, wherein said means for producing and directing comprises an external applied magnetic field.

14. The semiconductor source of claim 1, wherein said emission electrons are substantially thermalized such that an energy spread of said emission electrons at said emission surface is less than approximately 1 eV.

15. The semiconductor source of claim 14, wherein said energy spread is less than 0.1 eV.

16. The semiconductor source of claim 1, wherein said means for producing and directing said beam of seed electrons comprises a photocathode and a light source for photoinduced generation of said seed electrons from said photocathode.

17. The semiconductor source of claim 16, wherein said photocathode comprises a negative electron affinity photocathode.

18. The semiconductor source of claim 16, wherein said means for producing and directing said beam of seed electrons comprises a voltage source for applying an electric field to said seed electrons.

19. The semiconductor source of claim 16, wherein said means for producing and directing said beam of seed electrons comprises a unit for applying a magnetic field to said seed electrons.

20. The semiconductor source of claim 1, wherein said means for producing and directing said beam of seed electrons comprises a source selected from the group consisting of field emission source, thermionic source and thermal field emission source.

21. The semiconductor source of claim 20, wherein said means for producing and directing said beam of seed electrons comprises a voltage source for applying an electric field to said seed electrons.

22. The semiconductor source of claim 20, wherein said means for producing and directing said beam of seed electrons comprises a unit for applying a magnetic field to said seed electrons.

23. A method for obtaining emission electrons from a target comprising a wide bandgap semiconductor, said method comprising the following steps:

a) defining a target thickness between an illumination surface and an emission surface of said target;

b) generating a beam of seed electrons;

c) directing said beam of seed electrons at said illumination surface;

d) controlling an energy of said seed electrons such that said seed electrons generate electron-hole pairs in said target and a fraction of said electron-hole pairs supply said emission electrons; and

wherein said target thickness and said energy of said seed electrons are optimized such that said emission electrons are substantially thermalized at said emission surface.

24. The method of claim 23, further comprising producing and directing a beam of said emission electrons to an application unit.

25. The method of claim 24, wherein said application unit is a scanning electron microscope for employing said beam of said emission electrons for scanning electron microscopy.

26. The method of claim 24, wherein said application unit is a display for employing said beam of emission electrons in an image display.

27. The method of claim 24, wherein said application unit is a lithographic device employing said beam of emission electrons for lithography.